

SECURING THE SUPPLY CHAIN OF INDUSTRIAL PRODUCTS ON THE BASIS OF THE USE OF MODERN INFORMATION TECHNOLOGIES

Yu. Buryak, S. Zheltov

State Research Institute of Aviation Systems, Moscow, Russia

Keywords: *counterfeit, aircraft components, information technologies*

Abstract

There were reviewed the main causes of insecurity (unauthentic / counterfeit) products (aircraft components - AC) in the aviation market of the Russian Federation. There were formed principles of secure supply chains AC based on the use of advanced information technologies, including tagging of AC by computer-readable (radio frequency and barcode) labels and the organization of automatic identification of the units by multiple information criteria, implementation of a fully automated information processes to support the manufacturing and operation of the AC, the implementation of "real" time mode to control the passage of the processes of production and operation of the AC. There were developed the algorithms for determining the identity of the delivered and received sets of industrial products. Is formed structure of the applied automated information system in the form of software and technology platform with advanced set of descriptive, administrative, communication and functional facilities.

1 Introduction

One of the key areas to ensure the competitiveness of Russian aviation on domestic and international markets is coordinated providing its performances of effective and safe operation. However, the published studies [1] show that in Russia exists a permanent turnover of unauthentic, i.e. not corresponding to technical conditions production, the value of which according to various estimates is up to 2-7% of the total

turnover. The subject of discussion are the products with unconfirmed by manufacturer origin, products - twins, products with impaired life and resources, products with duplicate passports, etc.

Use of such products in the aviation industry is a direct threat to the conditions of safe use of air transport.

2 Statement of the Problem Research

The problem of counterfeit products is relevant in varying degrees to the economies of different countries and different groups of goods: food, perfumes, household appliances and so on. The causes of such products are diverse and have both objective and subjective reasons. However, despite of their diversity in aviation activity it worth to highlight the following main factors [2]:

- to its source should be attributed the stages of manufacturing and operation of the products, so it is necessary to use a wider informative description of products that is regulated by existing standards;
- its production of "profitable" to manufacturers and consumers, so the solution must be sought in the area of the balancing the economic benefits of the producers and the consumers through the establishing of legal safeguards;
- existing controls technical conditions of production involve the use of the "manual" labor, which is the source of conscious and random errors and

determines the need for automation of all business processes;

- in Russia there is "informational" gap between manufacturers and consumers of aviation equipment, so you must have a database of manufactured products and databases of products which are in operation and use them consistently.

As a universal mechanism for the detection of counterfeit products in the world is the use of an automated method for tracking the status of aircraft components (AC) in real time mode.

Thus, the security of supply chains of aircraft components is primarily an information task; it should be solved by successive automation of generation and manipulating the performances of products in the corresponding industrial processes.

The aim of this investigation is to develop a methodological approach and a computer system that ensures security of supply chains of aircraft components through integrated automation of informational processes for tracking product states.

3 Methodological Maintenance for the Organization of Secure Supply Chains of Industrial Products

Typical scheme of the production process is based on the coordination of workflows with intangible (information) objects that performed by the stakeholders at the "office" level of the system and operations with material objects, performed by the stakeholders at the production level of the system.

In this context it worth to highlight the following basic principles for synchronization these streams [3]:

- organization of production processes under the schema of "regulation works," which suggests a clear link tasks, work on assignments, and the results of data characterizing the conditions of work;
- identification by the machine-readable marking of all components (product + packaging + accompanying documentation) of AC set of delivery;

- organization of information exchange in the framework of "electronic document management";
- the organization of operational control of work in real time mode until the completion of the final operation;
- automated assessment of identity of delivered and received set of products based on the following operations: automated data collection about delivered/received products, formation of informational description of delivered/received product sets, comparison of informational description of delivered/received product sets.

Supplier is guided by the contract for the supply of products and performs the following functions:

- forms the product description and the accompanying items (packaging, documentation);
- forms the composition and content of tasks (from a template) for applying machine-readable information on the elements of delivery set;
- generates contents of readable identifiers and disposes them on the elements of delivery set;
- provides a complete delivery set and supplements the informative description of delivery set by relevant information from the machine-readable identifiers;
- forms a complete informative description of a particular delivery set (automatic operation);
- forwards to the consumer delivery set and its informative description.

Consumer is guided by the contract for the supply of products and performs the following functions:

- accepts the informative description of the received shipment and generates tasks for reading readable identifiers on the its elements;
- takes received shipment and reads machine-readable identifiers on its elements;

SECURING THE SUPPLY CHAIN OF INDUSTRIAL PRODUCTS ON THE BASIS OF THE USE OF MODERN INFORMATION TECHNOLOGIES

- generates the appropriate information for comparison with the informative description of the received set;
- authority shall compare readable identifiers of informative description and received elements (performed using automated computational procedures of DB);
- forms a conclusion about the identity of the received set (automatic operation) and delivery set according to the contract conditions.

The identity of the delivery and received sets of industrial products is verified by comparing the informative description

(reference) of delivery set and received set (fact). Identification of the "intruder" in the case of identity failure is performed by tracing corresponding events.

Organizational scheme (Fig. 1) for verifying the identity of the delivered and received products can be based on the operations of mutual authentication data about received / delivered products or by hiring an independent supervisory authority. If necessary to ensure the required level of confidentiality in the organization of information exchange can be applied regular means of information protection.

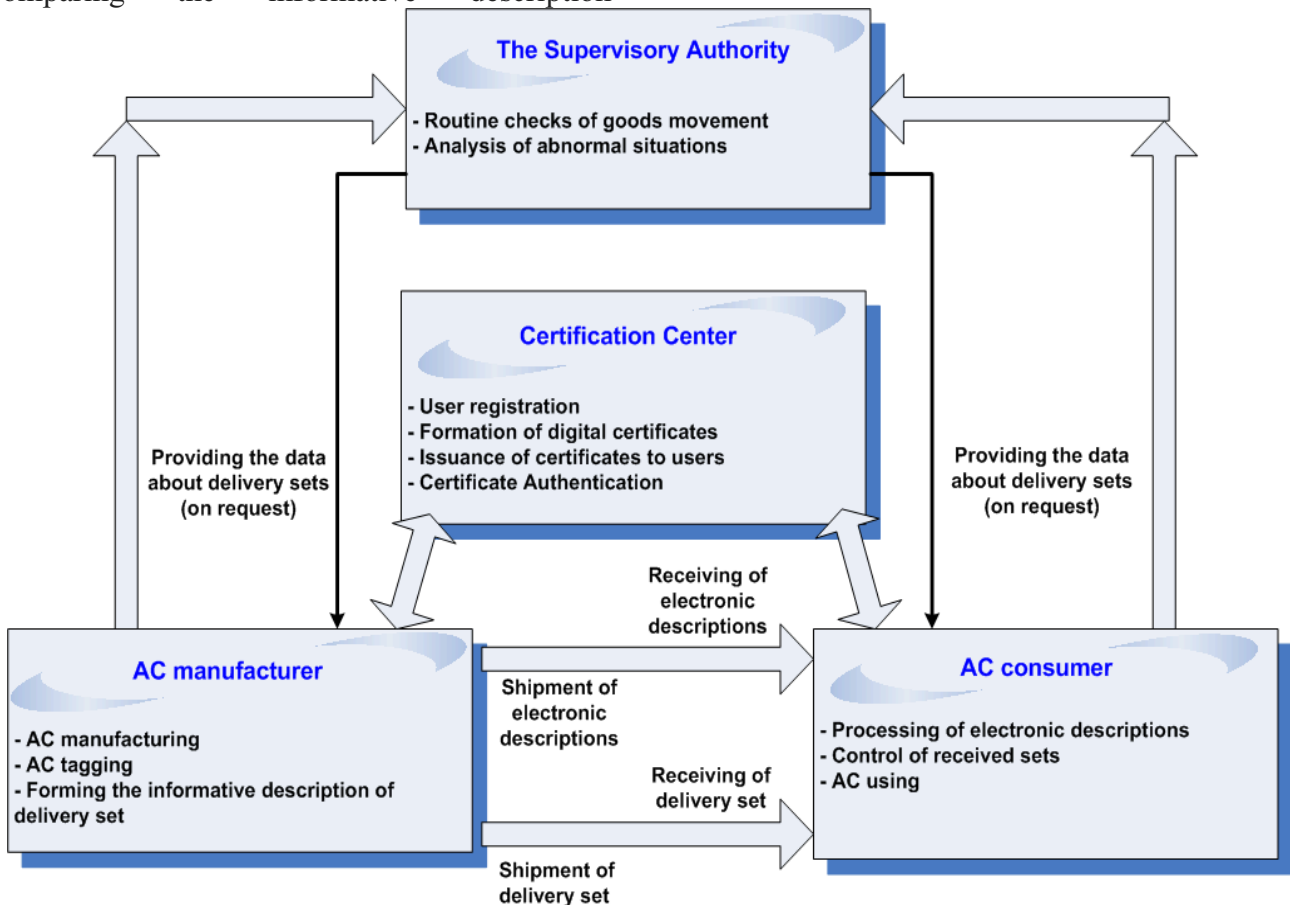


Fig. 1. Organization scheme of aviation aircraft components supply chains tracking during production and operation stages

Algorithmically issue tracking supply chains of industrial products is resolved by the automation of procedures to create a set of delivery, development the information describing this set, independent dispatch of the information and delivery set in the address of the supplier, the unfolding of the informative

description and comparison of its contents with the contents of the delivery set [3].

The key elements of the proposed system are authentication / not changing of the transmitted informative description and complete automation of procedures for its formation by the manufacturer of AC and consumer use.

The issues for informative description notification is offered to build by the standard scheme of digital signatures using.

4 Results of the Development

Solving the problem of preventing the use of counterfeit and substandard products involves creating systems of industrial products supply chains tracking based on the harmonized application of the complex of modern information technology: automatic identification, electronic document management and wireless communications in the course of the product life cycle, from the beginning of production to its disposal.

Software-algorithmic implementation of information processes automation task at AC manufacturer and consumer is proposed to build on the basis of use of the system for monitoring the status of objects of material flows in their life cycle (MSOMP system) developed by experts of the FSUE "GosNIAS" [4].

MSOMP system (Fig. 2) is designed for solving applied problems of the control in "real" time the state of an object in relation to the temporal characteristics (completeness of stages, operations) and resource provision of process, the quality of (marriage) products, legal supplies (counterfeit) and etc., on the production and post-production stages of the life cycle.

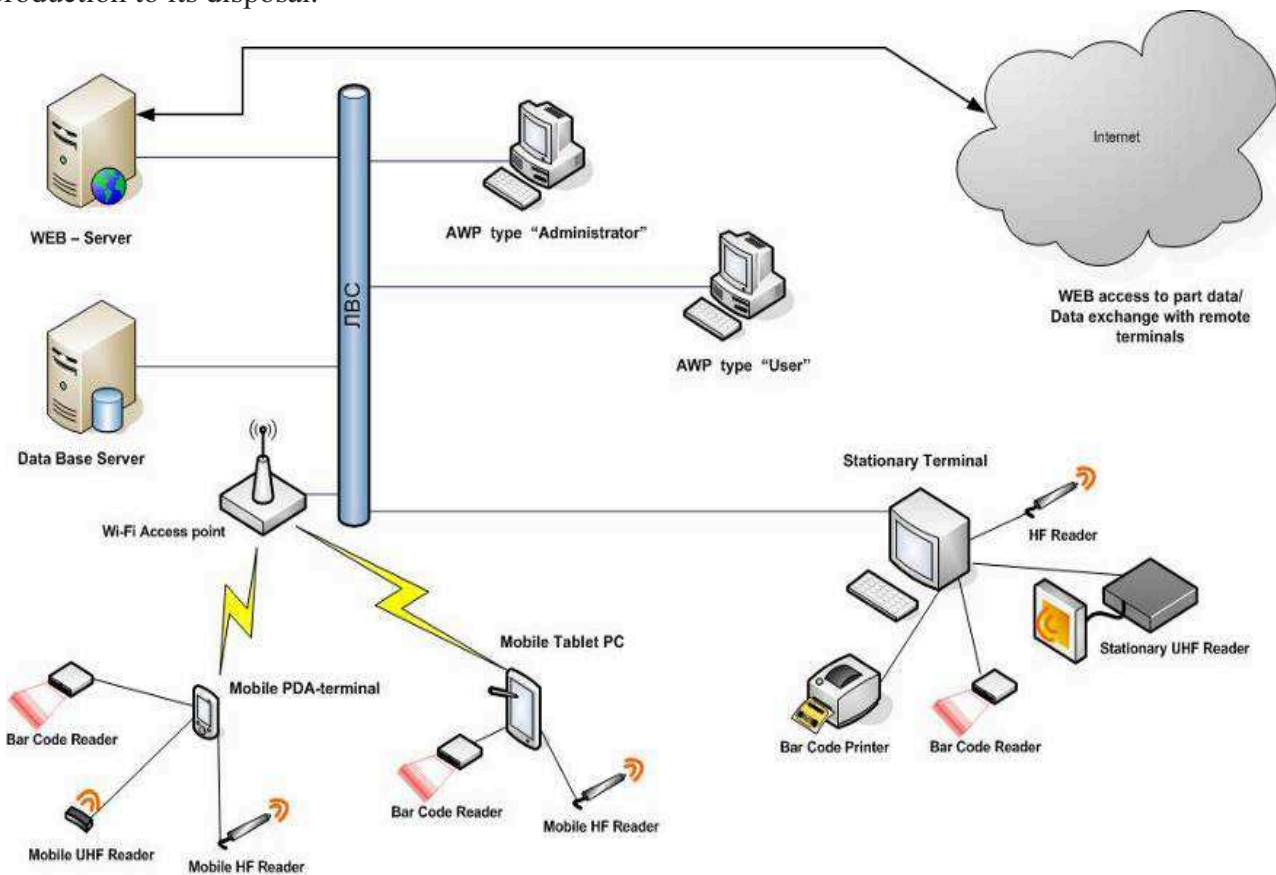


Fig. 2. Typical structure of application system based on MSOMP

The MSOMP system provides an implementation application subsystems and tasks in a unified distributed computing environment by its tuning on a specific subject area and allows users to work with a uniform input, output, circulating and stored information, including the information recorded in the radio frequency and bar-code labels,

placed on the products, packaging and accompanying documents.

MSOMP system has the following key benefits:

- directly aimed at supporting life cycles of labeled material objects (products, documents, packaging);

- support the broad composition of the equipment providing interaction with machine readable labels of various types;
- allows to work with mobile terminals at a locations being remoted from the point of direct access to the network (on the tarmac, in the hangar, in a shop, etc.);
- allows without additional coding to adapt the software for the specifics of a particular enterprise (organization) and the needs of specific users, as the basis for building a wide range of application monitoring systems;
- reduces the influence of the "human" factor on the accuracy of the data collected through full automation of information processes;
- provides administering and information security.

The composition of the basic configuration of the system consists of the following components:

- the database server;
- automative working place (AWP) type "Administrator";
- AWP type "User";
- hardware and software systems of data collection terminals;
- communications Server;
- WEB-server.

Data exchange in the listed components is performed within a local area network by using wired or wireless links. For information exchange terminals with monitoring system can use the Internet global network. The number of simultaneous copies of APM terminals is unlimited.

Each of the functions relating to the application of the system, possesses programmatic independence and completeness, allowing, if necessary, to modify the functional composition of the basic applications of the system or introduce new features.

5 Conclusion

The most important component of solving the problem of the safe use of industrial

products at all stages of the life cycle is receive complete and accurate information about its performances. To minimize the impact of the "human" factor when manipulating characteristics of the AC is allowed by the consistent application of following provisions:

- automatic identification of the product and the accompanying documentation;
- inclusion of operations with material objects in the integrated information processes;
- providing full automation of latest due to the regulation of the operations and the use of mechanisms of "electronic document management";
- provide feedback in real time mode by controlling the passage of processes.

Thus, the integrated use of existing developments in the field of information technology and normative provision of the industrial processes will provide the necessary status traceability of the both manufactured and in operation products to provide a real contribution to ensuring the required level of safety of the air transport of the Russian Federation.

References

- [1] Website of information-analytical center GosNIIGA. Authenticity. [Electronic resource] // Access mode: <http://www.mlgvs.ru/aut.html> (date accessed 12/11/2013).
- [2] Buryak Yu, Zheltov S. The experience in the use of modern means of automatic identification in tasks of quality management of industrial products and the safety of its operation and use. *Journal of Computer and Information Technology*, No. 9, pp. 2-7, 2006.
- [3] Buryak Yu, Amirkhanyan V, Kalinin V. Security of supply chains of industrial products based on the use of modern information technologies. *Journal of Computer and Information Technology*, No. 9, pp. 26-33, 2012.
- [4] Buryak Yu, Amirkhanyan V, Kalinin V. The development of software and technology platform to monitor the state of the construction of complex objects geographically distributed automated information systems for production purposes. *Journal of Computer and Information Technology*, No. 8, pp. 23 - 28, 2012.

Copyright Statement

The authors confirm that they, and/or their company or organization, hold copyright on all of the original material included in this paper. The authors also confirm that they have obtained permission, from the copyright holder of any third party material included in this paper, to publish it as part of their paper. The authors confirm that they give permission, or have obtained permission from the copyright holder of this paper, for the publication and distribution of this paper as part of the ICAS 2014 proceedings or as individual off-prints from the proceedings.